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Imitation Skill Development in Children with Autism Spectrum Disorders: Teacher-Directed versus Child-Directed Tasks

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This study examines the impact of teacher-directed and child-directed imitation tasks on skill development of children with autism spectrum disorders (ASD).

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C.E.K.

CONTENTS

TABLES

FIGURES

CHAPTER 1

THE PROBLEM AND ITS BACKGROUND

Statement of the Problem

Imitation is generally defined as a means by which individuals copy another person's behavior, emulating both the physical properties and connotation. Imitation can take the form of one or a combination of three types: object imitation, gestural imitation, or oral-facial imitation. Additionally, these types can be categorized as single (one behavior) or sequential (a series of connected behaviors), immediate (instant emulation following a model) or deferred (postponed emulation), and spontaneous (emulation occurs without prompt) or elicited (emulation directly prompted) (Sevlever & Gillis, 2010).

Growth in imitation continues throughout early childhood. By the time children are one year old, they engage in object imitation while playing with adults, copying adults' play behaviors in regards to toys. By the next year, children begin to play imitation games involving more gestures. Typical development continues to reciprocal imitation, in which the child and adult imitate each other as an exchange that promotes relationship building. This reciprocal imitation is thought to facilitate the development of language skills and early peer relationships, as children use object imitation to begin social interactions with each other (Eckerman & Stein, 1990; Eckerman & Didow, 1996). In toddlers, this type of interaction is the most common way of play between two children.

Through this continued use of imitation, children's social skills mature and grow (Ingersoll, 2008).

Unlike typically developing children, children with ASD – a neurodevelopmental disorder characterized by social and behavioral deficits (APA, 2014) – display qualitatively different behaviors in infancy, which may impact the ability to learn from imitation. Specifically, research has shown that children with ASD smile less in reaction to their mothers' smiles, rarely make eye contact, and lack preverbal behaviors during the first year of life (Dawson, Hill, Spencer, Galpert, & Watson, 1990). These absent signals of early imitation make the later lack of imitation development somewhat unsurprising. Research has shown that children with ASD can imitate when the behavior is elicited. However, unlike their typically developing counterparts, children with ASD do not usually imitate spontaneously (Ingersoll, 2008; Whiten & Brown, 1999).

Research examining the effectiveness of different types of interventions in increasing imitative ability in children with ASD has found various types of imitation improve when using discrete trial training (Lovaas, 1987) and Reciprocal Imitation Training (Ingersoll, 2008). However, the relative effectiveness of different interventions in improving the imitation skills of children with ASD has not been directly tested. The current study investigated the effectiveness of two types of imitation interventions, teacher-directed (discrete trial training) and child-directed (a component of Reciprocal Imitation Training) to improve spontaneous imitation skills in children with ASD. The effects of imitation training on the expressive language development in children with ASD were also be explored.

It was hypothesized that discrete trial training would produce a slight increase in spontaneous imitation ability. It was further hypothesized that even greater spontaneous imitation gains would be evidenced during the application of child-directed imitation training. Finally, it was hypothesized that participants would demonstrate an increase in expressive language over the course of the study.

CHAPTER II

REVIEW OF RELATED LITERATURE

Autism Spectrum Disorder (ASD), classified as a neurodevelopmental disorder, has shown a dramatic diagnostic increase over the past two decades (APA, 2014; Rice, 2014). Estimates indicate the current prevalence of the disorder averages one per every 68 children (CDC, 2014). A diagnosis of ASD can be reliably given as early as the age of two years; however, the average age of diagnosis is at five years, seven months (Shattuck et al., 2009). While the diagnosis can be given later – especially if placed in an environment with high social demands, such as school – a DSM diagnostic criterion requires that symptoms be evident early in development (APA, 2014).

The diagnostic criteria for ASD include two primary categories: social communication and social interaction deficits as well as limited repertoires of behaviors and interests. Communication deficits are perhaps most marked, with approximately fifty percent of individuals with ASD never developing functional language (DeMyer, 1972; Smith, Mirenda, & Zaidman-Zait, 2007). Even in those individuals who do speak, it is common for verbal behaviors to include stereotyped and repetitive language, including echolalic speech, limiting their ability to engage effectively in conversation with others. Significant deficits are also noted in receptive language skills, and individuals with ASD often have difficulties understanding spoken and written language. Social deficits may include few, if any, peer relationships, a lack of mutual sharing of interests or feelings, and atypical nonverbal behaviors unsuitable in regards to normal social interaction (APA,

2014). Finally, individuals with ASD typically exhibit a limited range of behaviors, interests, and activities. Classic examples include stereotyped and repetitive motor behaviors, being insistent on following rigid schedules, exhibiting distress when expected routines are interrupted. In addition to the categorical qualifications, these impairments must be evident in the early childhood years (before the age of eight), must significantly impair daily life functioning, and must not be the result of an intellectual disability or broader developmental delay. Finally, an ASD diagnosis is given with a severity rating in terms of impairment, with ratings ranging from level one ("requiring support") to level three ("requiring very substantial support") (APA, 2014).

Although not part of the diagnostic picture, deficits in imitation are widespread in individuals with ASD. Researchers have debated whether poor imitation skill development it is a core deficit associated with the disorder (Rogers & Pennington, 1991) or the result of other associated symptoms, such as deficits in theory of mind (Baron-Cohen, Leslie, & Frith, 1985) or emotion recognition and understanding (Hobson, 1986a & 1986b). Whether the imitation is a central deficit in ASD or a secondary effect of other impairments, it is one that affects development of communication and socialization skills, and is certainly a target for intervention (Rogers & Pennington, 1991).

Typical Development of Imitation

In typically developing children, imitation capabilities can be seen at as early as twelve to twenty-one hours following birth. Previous research has shown that infants of this age can imitate simple actions, such as sticking out one's tongue, and twenty-four hours later can also imitate facial expressions including happy, sad, and surprise (Meltzoff & Moore, 1977; Field, Woodson, Greenberg, & Cohen, 1982). Further, at six

weeks old, research has shown that infants are able to engage in deferred imitation of more complex motor routines, such as opening their mouths and sticking out their tongues twenty four hours after both actions were first shown to them (Meltzoff & Moore, 1994). At thirteen months, infants have the ability to truly imitate, meaning that they can understand a behavior's purpose and therefore imitate that behavior with the intention to accomplish that purpose (Carpenter, Nagell, & Tomasello, 1998). As these infants are unable to verbally communicate, researchers have posed that this type of imitation may serve a communicative function (Nadel, 1982).

Imitation becomes increasingly prominent in children eighteen months and older, its use hitting its zenith when children are thirty months of age. In children of this age, imitative social exchanges show norms of reciprocal communication such as taking turns and exchanging roles in a conversation (Nadel, 2002). Additionally, these imitative exchanges occur with temporal consideration, each child participating in a give-and-take depending on the start and finish of each other's actions. Interestingly, widespread use of reciprocal imitation seems to decline as children develop language. This implies not only imitation's communicative function, but also children's recognition of it as such (Nadel & Fontaine, 1989).

A crucial difference in imitation is the act of imitating another versus recognition of being imitated by another. Imitating someone else is the initiation of a social contingency with that person, implying that one is gaining that person's attention and then engaging him or her in a social exchange. Being imitated, however, involves being prompted for a social exchange; in order for this contingency to succeed, the subject of the imitation must be able not only to know that someone is imitating him or her but also

to be able to reply to this social contingency. Researchers hypothesize that the subject of the imitation understands the act as intentional (Nadel, 1982). While this socially-oriented theory explains the imitation deficit in ASD as a lack of understanding of imitation's social contingency, other theories have proposed a variety of different explanations for the impairment.

Development of Imitation in ASD

Individuals with ASD often exhibit differences in the amount and quality of imitation behaviors compared to their typical peer counterparts throughout childhood (Ingersoll, 2008). Several theories have been proposed to explain the source of the imitation deficits found in individuals with autism spectrum disorder. While these theories all recognize that imitation deficits exist and agree that imitation is an important precursor to academic, language and social development, they vary on both the reasons for and implications of the impairment. The following section illustrates eight different theories about the imitation deficit in individuals with ASD: theory of apraxia-related deficit (DeMyer, 1972), information processing theory (Smith & Bryson, 1994), the mirror neuron system (Rizzolatti & Craighero, 2004; Iacoboni & Dapretta, 2006), theory of mind deficits (Baron-Cohen, Leslie, & Frith, 1985), impairments in social processing, orienting, and motivation (Whiten & Brown, 1999; Dawson et al., 2004; Nadel, 2002), and the Development Individual-Difference Relationship-Based/Floortime Model's theory of a central nervous system deficit that affects sequencing ability (Greenspan & Wieder, 1997).

Apraxia-Related Deficit

The theory of apraxia-related deficit posits that the imitation deficit has a neurological foundation, specifically in a disorder called apraxia. This deficit is illustrated by an individual's inability to perform intentional motor movements in a specific order. Support for this idea is based on the research indicating that children with ASD have more difficulty performing multifaceted behaviors as compared with simpler ones (DeMyer, 1972). Additionally, this theory suggests that individuals with autism show an imitative impairment because they cannot physically replicate another's actions (DeMyer, 1972). While this theory may explain a part of the imitation deficit, research has reported only a 34% prevalence rate of motor apraxia in children with ASD. Further, research has shown that motor apraxia is more common in younger children, implying that the deficit may improve over time and therefore not be seen in older children (Ming, Brimacombe, & Wagner, 2007). The fact that this deficit is not universal and additionally disappears over time suggests that motor apraxia does not likely account for the broader deficit in imitation in children with ASD.

Imitation Processing Theory

The imitation processing theory suggests that the foundation of the imitation deficit in ASD is related to an underlying information processing deficit. This theory hypothesizes that individuals with ASD are unable to perceive others' actions and form representations in their minds and are therefore unable to successfully replicate those actions. Similar to the apraxia theory, this theory emphasizes that the imitation deficit itself is not inherently a social deficit but rather that the impairment has social side effects (Smith & Bryson, 1994). While cognitive deficits, correlated with information

processing impairments, are sometimes present in children with ASD, research has reported that they are not seen in most children with ASD, reporting a prevalence rate range of 46-62% (Rice, 2009). Additionally, oral-facial imitation has been shown to have a higher degree of impairment in children with ASD than object imitation, suggesting a more affective deficit rather than a cognitive one (Rogers, Hepburn, Stackhouse, & Wehner, 2003). Therefore, this theory may also account for part of the imitation impairment seen in children with ASD, but it does not explain it in full.

The Mirror Neuron System Theory

A plethora of neuropsychological research on imitation exists focusing on a hypothetical mirror neuron system. Evidence garnered from research with primates indicates that mirror neurons are activated when the primate detects an object-directed action. Found in the cortex of the superior temporal sulcus, it is suggested that mirror neurons primarily function as a method to understand the actions of others with an additional mediating function of imitation. The neurons further allow the primate to view and understand an action and encode it as information in the brain without having to physically perform the action itself. Additionally, if the action being observed is one that the primate has the ability to perform, the primate is more likely to copy that action. If it is not, the observation is encoded for future learning. In terms of the system's existence in humans, studies show evidence through the activation of the motor cortex when humans observe another's action without that human engaging in any motor activity him- or herself. (Rizzolatti & Craighero, 2004).

Specific research investigating the functioning of the mirror neuron system in individuals with ASD has revealed a link between the amount of activity in this neuronal

area and symptoms of ASD, with less activity associated with more severe ASD characteristics. Specifically, when engaged in a task that required participants to observe and imitate facial expressions, individuals with ASD showed less activation in the mirror neuron system than typically developing participants (Iacoboni & Dapretto, 2006). This neuropsychological evidence provides a possible biological basis for the imitation deficit found in children with ASD, further supporting the need for interventions to bolster this skill in this population.

Theory of Mind

Theory of mind is defined as the ability to know and understand what other people know, want, feel, and believe (Baron-Cohen, Leslie, & Frith, 1985). This construct has been used to explain imitation deficits commonly found in children with ASD. As aforementioned, in order to engage in imitation with another person, one must recognize that one is being imitated. This recognition implies that one must have some knowledge of the other person's intentions, a skill related to theory of mind. If children with ASD lack theory of mind, they may not be able to recognize that another person is imitating them and therefore be unable to engage in the reciprocal process.

The seminal study used to test theory of mind developed the Sally Anne test (Wimmer & Perner, 1983). This test presents the scenario of two girls, Sally and Anne. Sally puts a marble in a basket and leaves the room; promptly after, Anne removes the marble from the basket and places it in a box. Sally then comes back into the room to look for her marble. Children are then asked where Sally will look for her marble. To show the presence of theory of mind, children should say Sally will look in the basket, as in Sally's mind, that is where it should be since she left it there and is unaware that Anne

moved it. However, if children answer that Sally will look in the box, where it is now, it demonstrates that they are unable to see the situation from Sally's point of view and, therefore, lack a theory of mind (Baron-Cohen, Leslie, & Frith, 1985; Wimmer & Perner, 1983).

A study by Baron-Cohen and colleagues (1985) using the Sally Anne test found that 85% of typically developing children and 86% of children with mental retardation were able to correctly report that Sally would look in the basket, demonstrating strong evidence for theory of mind abilities in the normative population. However, 80% percent of the children with ASD reported that Sally would look in the box, failing the theory of mind task. The authors suggested that children with ASD are often unable to perceive and understand other people's mental states, therefore making imitation of others a difficult, if not impossible, task (1985).

The proposal of a theory of mind deficit has been supported by many replication studies (e.g., Rogers & Pennington, 1991; Charman et al., 1997). However, no research exists that has directly tested the relationship between theory of mind and imitation. Therefore, this link remains a theory rather than an evidenced fact.

Social Processing, Orienting, and Motivation Theories

An important component in imitation is the ability to recognize human beings as intentional actors (Nadel, 2002). Research has shown that by the age of eighteen months, typically developing infants are aware of the intentionality behind people's behaviors, even if the behavior they see someone perform does not realize the intended goal. Through the behavioral re-enactment paradigm, research has shown that infants are more likely to imitate actions that they perceive to have been premeditated than actions that

they perceive to be inadvertent. Specifically, infants who observed an adult performing goal-directed behaviors, whether they were successful or not, imitated these behaviors 75 percent of the time while infants who either watched no demonstrations or an adult's random behaviors toward objects did not imitate the adult's behaviors (Meltzoff & Moore, 1995). Additionally, infants were six times more likely to imitate an adult's unsuccessful goal-directed behaviors than a machine that performed the same actions as the adult who had previously demonstrated successful goal-directed behaviors (Meltzoff, 1995). This research highlights the importance of an infant's ability to consider both physical and psychological components of other people in imitation (Meltzoff & Moore, 1998 in Bråten, 1999).

Research has also shown that infants are able to detect equivalence between time and space in an imitation situation. In a study involving fourteen-month-old infants, two adults sat across a table from each infant. One adult imitated the infant while the other paid attention to the infant, but did not copy his or her actions. Results showed that the infant looked at and smiled at the imitative adult significantly more often than the non-imitative adult. Additionally, the infant also made sudden changes in their behavior as if to test the adult's level of imitation. This additional behavior seen in the infant implies that at this age, children understand that they have some power over an imitative situation (Meltzoff, 1990).

These findings raise the question of whether the imitation deficits found in children with ASD are due to broader social impairments and more specifically, a deficit in social processing. The functional approach to this subject suggests that the most important part of this deficit is not necessarily the lack of imitation ability but rather the

inability to recognize when one is being imitated. This approach posits that children with ASD actually develop imitation skills equivalent to those of typically developing children. While the majority of research suggests differences in imitation abilities between children with ASD and their typically developing counterparts, one study stands in contrast, finding that nonverbal children with autism will spontaneously imitate both typically developing children and enthusiastic, playful adults (Nadel, 2002). However, the authors assert that imitation does not continue to develop because children with ASD do not view humans as social beings. In other words, children with ASD do not expect humans to take part in this social contingency (Nadel, 2002).

Further evidence for this theory comes from studies that have examined social orienting and joint attention in children with ASD. A social orienting deficit is defined as an impairment in being able to spontaneously attend to social stimuli occurring in the environment. Research has demonstrated that children with ASD are less likely to orient to both social and nonsocial stimuli but have a particularly acute deficit in attending to social stimuli in comparison to children with developmental delays and/or typical development. A related deficit associated with ASD is in joint attention, which is the ability to share, attend to, and control the attention of another person. Similar to the findings on social orienting, research has shown that in comparison to children with developmental delays and/or typical development, children with ASD are less likely to engage another in joint attention as well as react to another's initiation of joint attention (Dawson et al., 2004).

This explanation is related to the motivation hypothesis, which suggests that because individuals with ASD do not necessarily view humans as social beings, they do

not have the drive to attempt to engage them in any type of social behaviors, for which imitation is a firm foundation. Additionally, this theory also proposes that imitation is not a general deficit in individuals with autism but rather specifically related to its social properties. Studies have shown that children with ASD can imitate when prompted to do so (Lovaas, Freitas, Nelson, & Whalen, 1967; Ingersoll, 2007; Ingersoll, 2008). Conversely, it has been shown that children with ASD do not spontaneously engage in imitation (Whiten & Brown, 1999; Ingersoll, 2008). This unprompted imitation is the type of imitation that is most closely related to social development, therefore suggesting that imitation is only impaired in children with ASD as it relates to social purposes (Whiten & Brown, 1999).

Promisingly, research has also shown that following a situation in which an adult imitates a child with ASD, the child's amount of imitation increases. In still-face paradigm studies (Nadel et al., 2000; Escalona, Field, Nadel, & Lundy, 2002) an adult enters a room in which a child is playing and sits in a chair, away from the child and without any emotion on his or her face. After an allotted amount of time, the adult engages the child through imitating the child's every action and noise for a set length of time. Following this engagement, the adult returns to the chair, void of emotion. The results of these studies have reported children approaching the adult, vocalizing and touching them, as if they are exploring the person. During this phase, when children were then prompted to imitate, the number of imitative behaviors they performed was significantly greater than during baseline. It is perhaps this demonstration of the human social qualities of others that engages the child with autism in further imitative and social interactions. This paradigm suggests that by the adult imitating the child, the child

becomes more likely to engage in further imitation with the adult. In order to determine whether the adult's engagement of the child by imitating him or her truly affects the subsequent predicted increase in the child's imitation performance, the current study implements the first part of this paradigm over several sessions and immediately assesses the child's spontaneous imitation ability after each session.

Despite the various theories on the source of the imitation deficit, researchers agree that this impairment does not exist in a vacuum but rather has an effect on other skills common in early childhood development.

Effects of Imitation Deficit on Development

Imitation deficits, common in children with ASD, have widespread impact on their development. Specifically, imitation abilities are related to successful mastery of receptive and expressive language skills, the ability to learn appropriate social interaction skills, and the development of play. Highlights of specific impacts are described below.

Language

As demonstrated by the use of imitation by preverbal infants and its subsequent disappearance once functional language has developed, it can be argued that imitation plays a crucial part in learning to communicate (Ingersoll & Lalonde, 2010). Imitation provides a basis for learning intentionality in human communication, an important notion that allows individuals to engage in a give and take style of connecting (Tomasello, Carpenter, Call, Behne, & Moll, 2005). A lack of imitation skills in children with ASD may explain some of the language deficits often shown in individuals with the disorder.

Imitation – specifically motor imitation – is predictive of the amount of expressive language in typically developing children as well as those with ASD (Stone &

Yoder, 2001). Research has shown that the degree of motor imitation in children with ASD at two years is a significant indicator of their level of expressive language ability at four years, no matter their language abilities prior to two years of age. As successful motor imitation requires an individual to both orient their attention to another person as well as create an image of that person's action in the mind, social information processing skills must be present. Further, the individual must have the motivation to engage with another person in the first place. These two skills must be present for language acquisition as well, as children often acquire language by observing and imitating individuals in around them (Stone & Yoder, 2001). Imitation through the body and the face has been found to be correlated with language development (Rogers, Hepburn, Stackhouse, & Wehner, 2003; Stone, Ousley, & Littleford, 1997); specifically, adolescents with ASD who were able to perform upper and lower facial imitation had more spontaneous speech than adolescents who could not (Freitag, Kleser, & von Gontardf, 2006).

Individuals with ASD often struggle with role reversal imitation. For example, children with ASD often have difficulty learning how to wave; when attempting to replicate the gesture, children will wave at others with their palms facing themselves instead of outward at other people (Carpenter, Tomasello, & Striano, 2005). This deficit in role reversal imitation is also reflected in the language of individuals with ASD, often characterized by echolalia, personal pronoun errors, and the incorrect use of questions versus statements. For example, a child with ASD may misattribute the question, "How are you?" to be related to the asker of the question and reply, "You are happy" (Peeters, Grobben, Hendrickx, Van den Eede, & Verlinden, 2003). Difficulty in role reversal

imitation reveals a central consequence of the imitation deficit – the inability to correctly attribute and act upon the intentions of others. Additionally, research has shown that children with ASD who have better role reversal imitation skills also have better language skills (Carpenter, Tomasello, & Striano, 2005).

Social Interaction and Skills

Imitation has been shown to be a precursor and introductory method for social interaction. Therefore, poor imitation skills may contribute to the consistently low occurrence of quality peer relationships in young children with ASD (Ingersoll, 2008). Studies have shown that at twenty-four months of age, children who are imitated will more often continue to engage in a game, create a new game with another person, and look at the other person's face (Eckerman & Stein, 1990). Additionally, research has shown that nonverbal imitation results in a shared understanding of play activities, leading to an increase in verbal means of play interactions (Eckerman & Didow, 1996).

As imitation deficits negatively impact other areas of development, it is important that research examine different types of interventions to facilitate the development of imitation and its secondary effects. Various interventions have yielded success in promoting the development of imitation skills (e.g., discrete trial training, pivotal response training, reciprocal imitation training). For the purposes of this investigation, two such treatments will be reviewed: discrete trial training, a behaviorally-based intervention that focuses solely on direct elicitation of imitation, and Reciprocal Imitation Training (RIT), which facilitates not only the direct instruction of imitation but also its spontaneous use (Lovaas, 1987; Ingersoll, 2008).

Discrete Trial Training

Discrete trial training is a structured form of direct instruction that uses applied behavior analysis principles such as reinforcement, prompting, and shaping successive approximations to teach a new behavior. Discrete trial training occurs over several trials until a skill is mastered, each trial consisting of five steps: first, a cue, such as "Time to work" or "Look", is given to signal the child it is time to begin to work. Second, the instructor gives the child a direction; in the case of imitation training, it may be, "Do this", while the instructor performs an action. Third, the child responds to the instructor's action. Fourth, the instructor provides a consequence for the child's action. If the child performs the action correctly, the consequence is a form of positive reinforcement. If the child performs the action incorrectly or does not respond, the instructor will use either verbal, gestural or physical prompts until the child completes the action, after which the child will receive positive reinforcement. Finally, the instructor pauses after the consequence is given before moving onto the next trial (Lovaas, 1987). Discrete trial training has been used successfully in teaching imitation skills to children with ASD (Lovaas, Freitas, Nelson, & Whalen, 1967; Baer, Peterson, & Sherman, 1967; Lovaas, Berberich, Perloff, & Schaeffer, 1966). However, generalization to other forms of imitation are rarely seen. It is hypothesized that this type of training does not result in an increase in spontaneous imitation ability (Ingersoll, 2008), but direct tests of the relation between this method of intervention and spontaneous imitation skills in children with ASD are scant.

Reciprocal Imitation Training (RIT)

Reciprocal Imitation Training (RIT) is an imitation intervention that is based on natural social interactions. The purpose of this method is to teach the child how to use imitation to engage in social behaviors while continuously communicating with an adult. During the first phase of this method, the adult imitates all of the child's actions, verbal and nonverbal. This encourages the child to pay attention to the adult, so that in the later phase, the child will be more likely to attend to and imitate the adult. While the adult imitates the child, he or she describes the behavior that they are enacting together; this addition of language into the method may increase imitation of language in the child. Following this phase, the second phase of RIT begins, wherein the adult teaches the child how to imitate (Ingersoll, 2008).

The teaching phase of RIT has three main goals. First, the adult wants to make the child want to imitate him or her. This goal is attained by the adult modeling behaviors that the child already knows and that make sense to the child in the context of play. The adult also reinforces the child through praise, something that is likely to occur in the natural environment outside of treatment. Second, RIT purports to encourage spontaneous imitation. By describing behaviors rather than commanding the child to perform them, the child will imitate behaviors he or she finds interesting and motivating. Finally, the imitation extends to other settings and time periods rather than only the treatment session. To accomplish this, the adult focuses on imitation attempts and approximations instead of exact productions of a behavior. Any and every attempt a child makes to imitate the adult is provided with verbal reinforcement (Ingersoll, 2008).

The second phase of RIT follows a spontaneous, social model of imitation. Previous research has shown that the core of the imitation deficit in individuals with ASD may be specifically related to its social component. In a study that compared the predictive constructs in relation to the effectiveness of three different imitation treatment contexts (direct elicitation, interactive play, and observational learning), results showed that in the interactive play condition, social reciprocity was significantly positively related to motor imitation skills, even when developmental level was held constant. Additionally, this study found that children performed more imitation under the direct elicitation condition than the interactive play condition, supporting the idea that core imitation deficits lie in its social factor. However, the interactive play condition did show an increase in imitation and possibly targets the most salient deficit and therefore is an important part of the treatment (McDuffie, Turner, Stone, Yoder, Wolery, & Ulman, 2007).

Another study by Ingersoll replicated these results with the addition of a control group of typically developing children. Results showed that children with ASD did not perform significantly differently than their typically developing peers in the elicited imitation condition but they imitated significantly less than the typically developing children in the spontaneous imitation condition. Furthermore, typically developing children did not show a significant difference in performance between the elicited and spontaneous imitation conditions, suggesting that spontaneous imitation may be particularly impaired in children with ASD (2007).

Further support of the use of a spontaneous and social imitation condition in treatment comes from the Still-Face Paradigm. This structured session involves four

phases, each lasting three minutes. In the first phase, a strange adult enters the room in which the child is playing and sits in a chair without paying any attention to the child or showing any emotion. In the second phase, the adult imitates all of the child's behaviors, both social and object-directed. The third phase is a replication of the first phase, followed by the fourth phase, which is spontaneous interaction between the child and the adult. Results of this procedure showed an increase in child's attention to the adult during both the third and fourth phases. This increased attention was manifested in looking at, smiling at, touching, and vocalizing to the adult. These attentive behaviors were also exhibited significantly more than simple gross motor behaviors. Additionally, an increase in negative emotional behavior, such as frowning at the adult, was shown in the third phase during which the adult rescinded the previous attention they had been giving the child. The authors of the study suggest that this increase in attentive behaviors may be due to the development of a social expectancy of the adult from the child (Field, Field, Sanders, & Nadel, 2001).

A follow-up study involving this Still-Face Paradigm compared the differences in child responses to imitation versus contingent responding. As compared to the imitation condition, the contingent responding condition involved the adult paying attention to the child's behaviors and responding to them but not initiating interaction through imitation. Results indicated that children demonstrated more attentive behaviors toward the adult in the imitation condition rather than in the contingent responding condition, as demonstrated by a decrease in motor and verbal stereotypies and a greater increase in social touching toward the adult in the imitation condition (Escalona, Field, Nadel, & Lundy, 2002).

The current study compared the effectiveness of the direct elicitation of imitation found in the structure of discrete trial training, a common form of intervention with children with autism, with the more naturalistic, albeit less common, child-directed imitation intervention found in the Still-Face Paradigm and Reciprocal Imitation Training (Lovaas, 1987; Escalona, Field, Nadel, & Lundy, 2002; Ingersoll, 2008).

Statement of the Problem

Imitation is an important skill for human beings to acquire as it provides the basis for learning more complex skills, such as communication and social skills. Typically developing children begin to exhibit imitation within the first days of life (Meltzoff & Moore, 1977) and continue to develop a wider repertoire of imitation skills through their interactions with people and the environment. Imitation skills continue to develop throughout childhood, and expand to provide the basis for learning language and other complex behaviors. For example, by twelve months of age, children are able to understand a behavior as purposeful as well as to imitate a behavior with the same intention (Carpenter, Nagell, & Tomasello, 1998). Further, by thirty months of age, typically developing children demonstrate knowledge of reciprocal communication norms in their imitation abilities, reflecting temporal norms (Nadel, 1986). While typically developing children show this developmental progression in imitation, children with ASD do not naturally develop imitation skills.

Numerous theories surround the etiology of the lack of imitation ability in children with ASD. These theories focus on constructs ranging from cognitive deficits such as a lack of theory of mind (Baron-Cohen, Leslie, & Frith, 1985) to neuropsychological impairments in stimuli processing (McPartland et al., 2004; Webb et

al., 2003) to a lack of social processing, orienting, and motivation (Whiten & Brown, 1999; Dawson et al., 2004; Nadel, 2002). While research has not yet settled on a definitive cause for the imitation impairment, studies have demonstrated the effectiveness of different interventions to improve imitation abilities in children with ASD.

Interventions that have proved to be successful in this area include discrete trial training (Lovaas, 1987) and reciprocal imitation training (Ingersoll, 2008). Discrete trial training is a program based in applied behavior analysis that focuses on the operant conditioning of new behaviors. While studies have demonstrated this method's effectiveness in eliciting imitation directly, it has shown less success in the development of spontaneous imitation skills (McDuffie et al., 2007). Reciprocal imitation training attempts to provide a supplement to this missing piece, the focus of the intervention being to increase imitation in natural social environments. Reciprocal imitation training adds a phase of child-directed imitation, wherein an adult imitates the child's actions, prior to engaging the child in a more teaching-based format of imitation learning (Ingersoll, 2008). While previous research has studied the correlations between motor imitation and different types of interventions (McDuffie et al., 2007; Ingersoll, 2007), no studies have directly assessed the effectiveness of discrete trial training compared with child-directed imitation on the spontaneous imitation ability of children with ASD.

The current study directly compared the effectiveness of teacher-directed imitation (discrete trial training) and child-directed imitation on the development of spontaneous imitation skills in children with ASD. In a multiple baseline across participants design, participants' spontaneous imitation ability was assessed following both teacher-directed and child-directed imitation sessions. Additionally, as research has

demonstrated a relationship between imitation and expressive language ability (Stone & Yoder, 2001), participants' expressive language skills were assessed following the conclusions of the teacher-directed and child-directed imitation conditions. As it is estimated that only fifty percent of individuals with ASD possess functional language, it is important to examine and discover the most effective ways to cultivate this essential skill in this population (DeMyer, 1972; Smith, Mirenda, & Zaidman-Zait, 2007). Based on current research on imitation intervention effectiveness as well as the corollaries associated with imitation development, three hypotheses were associated with the current study.

It was hypothesized that discrete trial training would produce a slight increase in spontaneous imitation ability. It was further hypothesized that much greater spontaneous imitation gains would be evidenced during the child-directed imitation condition of the study. Finally, it was hypothesized that participants would show an increase in expressive language over the course of the study.

CHAPTER III

RESEARCH DESIGN

Method

Participants

In the current study, three participants with a medical or educational diagnosis of autism were recruited for participation through a Midwestern autism services clinic. Exclusionary criteria included having sufficient imitation skills prior to the study, defined as scoring 75% or higher on the spontaneous imitation screening assessment, described below; or having insufficient motor skill ability to complete the imitation tasks. Specific characteristics of each participant are described below.

The first participant, Daisy, is a Caucasian female diagnosed with autism spectrum disorder (ASD). She was three years, six months old at the beginning of the study. Daisy's score on the ADOS-2 reflected a diagnosis of autism and she scored 5% on the spontaneous imitation screening assessment.

The second participant, Patrick, is a Caucasian male diagnosed with autism spectrum disorder. He was four years, 2 months old at the beginning of the study. Patrick's score on the ADOS-2 reflected a diagnosis of falling on the autism spectrum. His initial score on the spontaneous imitation assessment was 50%.

The third participant, John, is an African male diagnosed with autism spectrum disorder. He was 4 years, 7 months old at the beginning of the study. John's score on the ADOS-2 reflected a diagnosis of autism. His initial score on the spontaneous imitation

assessment was 10%.

Setting

All experimental sessions were conducted in a room measuring approximately 15 by 15 feet. The room was equipped with a child-sized table, two chairs, and 10 sets of identical pairs of objects.

Measures

Pre-assessment imitation battery. This assessment measures a child's spontaneous imitation of adults. Tasks on this assessment were drawn from a modified version of the Unstructured Imitation Assessment (UIA; adapted from McDuffie et al., 2007 cited in Ingersoll, 2010). During this assessment, the evaluator attempts to engage the child in imitation in an indirect method. The experimenter performs actions and call attention to those actions by describing to the child what she is doing. For example, the experimenter may place a hat on her head while saying, "I am putting a hat on my head". Previous research has demonstrated moderate internal consistency for this measure (α = .66) (Ingersoll, 2010). Please see Table 1 for specific tasks that were used during this pre-assessment screening measure.

Participants' responses on spontaneous imitation tasks were coded on a three-point scale with a 0-2 range, a score of "0" representing a failure to imitate, a score of "1" representing an attempted but not complete imitation, and a score of "2" representing a complete imitation (Ingersoll, 2008). Details of the coding system are provided below.

A score of "2" indicated that the child did complete movement that the experimenter performed. This involved a very close typography to the action performed by the experimenter, but the number of times the action was performed and the intensity

with which it was performed could be different. For example, the adult may have clapped her hands three times while the child clapped his or her hands only once.

A score of "1" indicated that the child did a close approximation of the movement performed by the experimenter. The movement could be a loose approximation of the action performed by the teacher. For example, the experimenter may have wrapped a boa around her neck, but the child may have only laid the boa across his or her shoulders – an emerging response.

A score of "0" indicated that the child did not attempt to imitate the movement/action of the experimenter, or the child engaged in some alternate behavior with the object (or any other object in the room).

Table 1.

Pre-assessment Tasks: The Unstructured Imitation Assessment (UIA)

Object	Motor
Place ball on head	Wave hand
Roll ball	Clap hands
Move toy car back and forth	Put fingers on lips
"Jump" frog	Open close fist
Bang two cubes together	Squint

Spontaneous imitation assessment. The spontaneous imitation assessment consisted of ten trials each day where participants had the opportunity to imitate motor behaviors with and without objects. During this assessment, the experimenter attempted to engage the child in imitation in an indirect method. Specifically, the experimenter performed actions and called attention to those actions by describing to the child what she was doing. For example, the experimenter may have placed a hat on her head while saying, "I am putting a hat on my head". Two verbal prompts were provided for each task, but no physical prompts were given for any task, no matter the response from the participant. During this assessment, participants received verbal feedback. If the participant performed a full imitation, the researcher said, "We're doing the same thing!" If the participant performed only a partial imitation or no imitation at all, the researcher described something else that the participant was doing (e.g., "You're rolling the ball!"). A total of ten tasks, five object imitation and five motor imitation, were randomly selected out of forty tasks for each assessment session using a random number generator. By having forty possible tasks from which to choose as well as randomly choosing them for each session of each phase, the likelihood that any participant learned any specific tasks and therefore compromised the validity of the treatment interventions' effectiveness was greatly decreased. These tasks were adapted from those used in prior research (McDuffie et al., 2007; Ingersoll, 2007). Table 2 contains the complete list of tasks.

Table 2.

Imitation Training and Assessment Tasks

OBJECT	MOTOR
1. Clap spoons	1. Raise hand

2. Roll car	2. Clap hands
3. Place umbrella over head	3. Thumbs up
4. Bounce ball	4. Wave hand
5. Put pacifier in doll's mouth	5. Put hand on wall
6. Clap kaleidoscopes	6. Nod head
7. Swing boa	7. Shake head
8. Hold cup to doll's mouth	8. Point at window
9. Put spoon in box	9. Put hand on cheek
10. Put blanket on doll	10. Put hand on nose
11. Hold kaleidoscope to eye	11. Put hand on head
12. Rock baby doll	12. Make fist
13. Roll ball	13. Put hand on shoulder
14. Put ball in box	14. Put hand on elbow
15. Shake kaleidoscope	15. Put hand on table
16. Stack bowls	16. Tap table
17. Pretend to eat out of bowl with spoon	17. Put hand on neck
18. Stack plates	18. Put hand on mouth
19. Pretend to drink out of cup	19. Put hand over eye
20. Stack boxes	20. Put hand over ear

Spontaneous imitation assessments were conducted during each session across each condition and served as the primary dependent variable.

Expressive language. Participants were presented with a set of picture cards. The experimenter held up one card at a time and oriented the participant to the card with a verbal prompt of, "Look!" Once the experimenter had the participant's attention, the experimenter asked, "What is this?" The experimenter did not give any feedback to the participant following his or her answer. This assessment was conducted at the end of each phase. Scores on this assessment were based on the complexity of language the participant used to answer the question "What is this?" when presented with each picture. Participants received one point for each component of the picture he or she verbally described. For example, if a participant simply said, "car" when shown a picture of a car, he or she received one point. If a participant said, "Big, red car" he or she received three points. A total of ten picture cards were be used and randomly ordered for each assessment session using a random number generator.

Design

Treatment was implemented in a noncontingent multiple-baseline across participants design. The dependent measure was performance on spontaneous imitation trials. All participants began at baseline. The baseline session consisted of a set of ten trials of spontaneous imitation (described in detail below). Baseline sessions were repeated until the participant showed a stable level of responding, as defined by at least three consecutive data points that were determined to be stable or to show a decreasing trend as is consistent with the conventions of single-subject design.

Once stable baseline performance is achieved for the participant, he or she began condition one. After stable performance was demonstrated in condition one, he or she began condition two.

Each participant was exposed to each condition following the rules of a noncontingent multiple-baseline design across participants. In order to measure the impact of intervention on expressive language skills, one probe was conducted at the end of each phase.

Data Collection and Reliability

All sessions in each condition (baseline, teacher-directed imitation, child-direction) were coded by viewing videotapes. A researcher who did not conduct the session being scored served as the coder. Twenty-five percent of participants' data were coded by two independent observers in order to calculate inter-observer agreement. Inter-observer agreement was calculated by dividing the number of agreements by the sum of agreements and disagreements.

Procedure

Recruitment. Members of a local parent support group for children with ASD were contacted in person to request participation in the current study. Parents were provided with a detailed written and verbal explanation of the study and had the opportunity to give consent for their child to participate in the study. Formal assent was not be obtained from the children, due to their limited language capabilities, but the researchers asked the parents to describe how to know if a child was willing to cooperate in activities and looked for behavioral signs that may indicate non-participation interest (e.g., crying, attempting to leave the room) in the children.

Assessment of imitation skills. In order to determine spontaneous imitation skills prior to intervention, each participant was screened through a pre-training imitation assessment. Ten trials, five object imitation and five motor imitation, were conducted.

Each participant received the same ten tasks that are presented in Table 1. Imitation performance was coded on a scale of 0-2 following the procedures described above. Participants who scored fourteen points or lower, or less than 75%, qualified for the study.

Intervention. Each experimental session took place in a room that contained a diverse assortment of toys, including some toys in identical pairs. Each session was divided in three parts: object imitation, motor imitation, and spontaneous imitation assessment. Each intervention phase consisted of ten trials of imitation training tasks and ten trials of spontaneous imitation assessment, each randomly chosen from the tasks listed in Table 2. These intervention sessions occurred two to three times per week. There were three conditions of intervention: baseline, teacher-directed intervention, and child-directed intervention. Details of each phase are described below.

Baseline. All participants began in baseline to determine the level of spontaneous imitation prior to the implementation of the two treatment conditions. During baseline sessions, ten randomly selected spontaneous imitation assessment tasks were conducted with each participant. These tasks were chosen from the list of tasks in Table 2, with a total of five object and five motor imitation tasks for each baseline session. No feedback or prompting in reference to the participants' imitation performance was given. However, the child was provided with reinforcement for appropriate task behaviors or maintenance behaviors (ones they have already learned and can easily demonstrate) approximately ten times each session, to keep the rate of reinforcement consistent between baseline and treatment conditions.

Condition one: Teacher-directed imitation. Teacher-directed imitation consisted of 10 training trials (5 object and 5 motor) using discrete trial training, followed by 10

opportunities for spontaneous imitation (dependent variable in this study). Specifically, during this condition, the experimenter and child were either seated across the table from one another as is traditionally done in this type of imitation training, or worked on the floor, depending on the child's attention capabilities (Lovaas, 1987; Maurice, Green, & Luce, 1996). In the object imitation portion of the battery, the experimenter then chose a toy that had an identical pair that the child had not been playing with, got the child's attention with the verbal command "look at me", and then modeled a developmentally appropriate action with the toy accompanied by the verbal prompt "Do this". The experimenter then looked at the child and waited for them to imitate the action for five seconds. If the child responded correctly, their imitation behavior was reinforced and the trial was over. If the child responded incorrectly, the experimenter provided prompts to elicit the correct response. The trial was over when the child performed the correct response. In the motor imitation part of the battery, the experimenter followed an identical procedure to the object imitation portion with the exception of modeling actions that did not involve any items. For example, during one task, the experimenter said, "Do this", and then waved her hand. The tasks for this phase were drawn from the list in Table 2 and were randomly generated each session to provide five object and five motor imitation tasks. During the teacher-directed imitation condition, all props used for the imitation tasks were in front of and accessible to the child.

Following the completion of the ten trials of imitation training tasks, participants were assessed on ten spontaneous imitation tasks. These tasks were chosen from the list of tasks in Table 2, with a total of five object and five motor imitation tasks for each assessment. Just as during baseline, no feedback or prompting related to the participants'

imitation performance was given. However, the researcher reinforced the child for appropriate task behaviors or behaviors that he or she already had learned approximately ten times each session.

Condition two: Child-directed imitation. This condition was directly modeled after both the Still-Face Paradigm and RIT. This condition differed from the teacher-directed condition in that the participant guided all interactions. During this phase, the adult imitated any and all of the child's actions for a period of five minutes (approximately the same amount of time it took to complete 10 discrete trial training tasks). For example, if the child rolled a car back and forth across the table, the experimenter rolled a car back and forth across the table. If the child flapped their hands, the experimenter flapped their own hands.

Following the five minutes of child-directed imitation, the participant received ten trials of spontaneous imitation assessment tasks. The procedure was identical to the description in both baseline and condition one.

Research Team Training and Treatment Integrity

The research team for the current study was comprised of four graduate students in school psychology and five undergraduate students. The research assistants who implemented the interventions received individual training in discrete trial training to teach imitation, reciprocal imitation training, and the expressive language assessment. First, demonstrations of each type of assessment and intervention were provided, with opportunity for questions. Following the demonstrations, research assistants practiced each intervention and assessment with a partner and received live feedback on their performance. Research assistants who coded videos of the participants' interventions and

assessments received training in the form of instruction on the coding procedure as well as opportunities to practice coding videos with immediate feedback and discussion of ratings. Research assistants were required to meet a criterion of 90% accuracy in their coding. Inter-observer reliability was calculated for twenty-five percent of the videos. This percentage was calculated by the number of agreements divided by the number of agreements plus disagreements and then multiplied by 100. The mean overall inter-observer reliability was 89.33%, with a range of 33%-100%.

CHAPTER IV

RESULTS

The results are organized as follows: First, baseline data on all participants' spontaneous imitation and expressive language skills are summarized and presented in order to describe those skills prior to intervention implementation. Second, single-subject design data is presented and each research question is discussed.

Baseline Data

Prior to each participant's participation in intervention, baseline assessments in spontaneous imitation ability and expressive language skills were conducted. No participants met the exclusionary criteria of a score of 15 (75%) in spontaneous imitation prior to the beginning of intervention. However, participants did demonstrate differences in terms of their spontaneous imitation skills at the start of the study. Similar differences were also observed in terms of expressive language skills.

Individual data for each of the three participants is presented.

Table 3

Baseline Spontaneous Imitation Results

Name	Min.	Max.	*M(SD)*
Daisy	0	5	*1.56(2.46)*
Patrick	1	14	*6.86(3.80)*
John	0	4	*2.71(1.99)*

Note. Scores represent number of spontaneous imitations.

Table 4

Baseline Expressive Language Results

Name	Number of Words
Daisy	0
Patrick	13
John	0

Note. Scores represent number of words spoken.

Hypothesis One

The first hypothesis of the current study was that participants would show an increase in spontaneous imitation as well as expressive language skills following a discrete trial intervention in imitation. In order to examine this question, individual baseline, intervention and assessment data were graphed, as presented in Figure 1, the x-axis representing the order of sessions and the y-axis representing the total number of spontaneous imitations performed during each session.

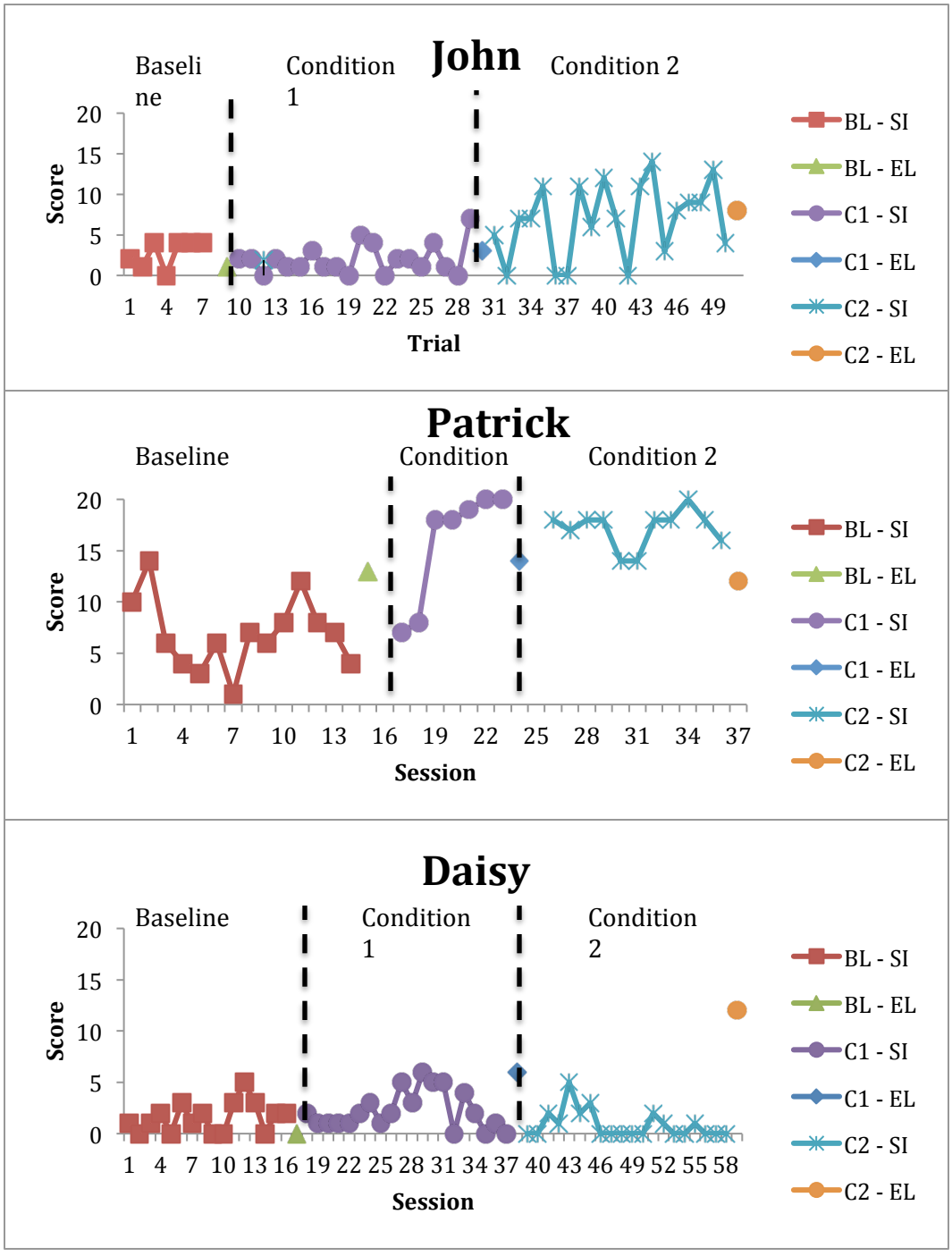

Figure 1. All participants: Spontaneous imitation and expressive language

Between the baseline and first condition, only one of three participants evidenced change in spontaneous imitation that could be attributable to the intervention. Specifically, Patrick, demonstrated a positive change in trend and level with 71% of the data points between these conditions being non-overlapping. In contrast, neither Daisy nor John evidenced change in trend or level in spontaneous imitation with only 5% and 10% of non-overlapping data points for Daisy and John, respectively.

In order to provide a context for interpreting the spontaneous imitation data, Table 5 summarizes discrete trial training performance for each participant, and the specific discrete trial data for each participant are presented in Figures 2, 3, and 4.

Table 5

Discrete Trial Training Results

Name	Number of sessions	Mastery session
Daisy	20	10
Patrick	7	1
John	20	11

Figure 2 represents discrete trial training data for Daisy, with the x-axis depicting sessions and the y-axis depicting percentage correct. At the beginning of the discrete trial imitation intervention, Daisy demonstrated a relatively low percentage of accuracy in terms of elicited imitation, showing a range of 5% of 40% correct. On the tenth session, Daisy demonstrated a large increase in this skill, achieving 80% correct. Following this gain, she showed a variable performance, primarily achieving above 50%. Changes in discrete trial training performance were not mirrored in the spontaneous imitation assessments (see Figure 1 for details).

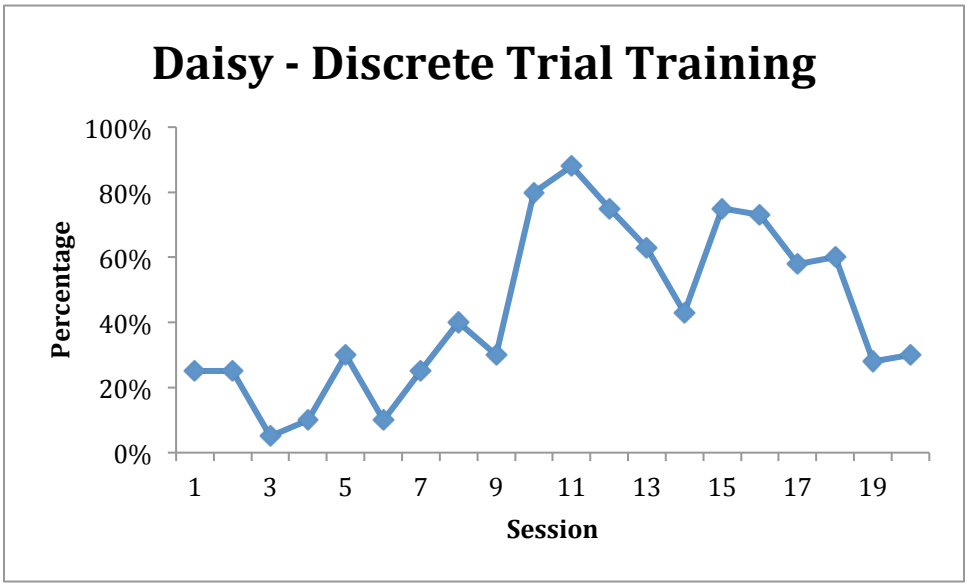

Figure 2. Daisy: Discrete trial training in imitation

Figure 3 represents discrete trial training data for Patrick, with the x-axis depicting sessions and the y-axis depicting percentage correct Patrick demonstrated strong skills in elicited imitation from the start of the intervention. He showed a range of 75% to 100% independence in during discrete trial training in this skill. Following two days of discrete trial training intervention, Patrick's spontaneous imitation assessments improved to mastery levels. (see Figure 1 for details).

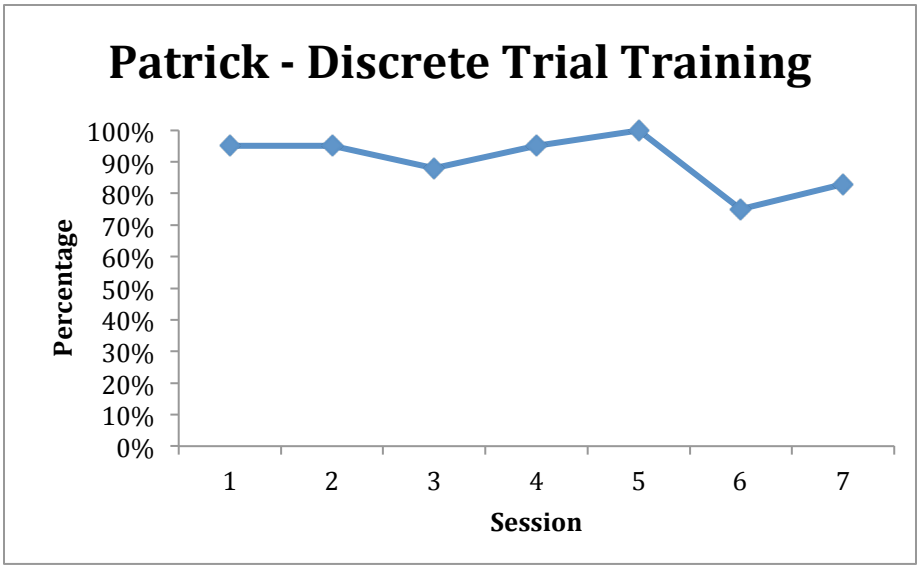

Figure 3. Patrick: Discrete trial training in imitation

Figure 4 represents discrete trial training data for John, with the x-axis depicting sessions and the y-axis depicting percentage correct John possessed a low level of skill in elicited imitation at the beginning of the intervention. He reached his highest performance in the skill at session 11, but failed to reach mastery criterion of 80% over the course of twenty sessions. However, due to IRB limitations of twenty sessions per condition, the researchers could not continue to implement this intervention. Following this high point, John showed variable performance in elicited imitation, primarily remaining below a median of 50% independence. No changes were noted in John's spontaneous imitation during this condition (see Figure 1 for details).

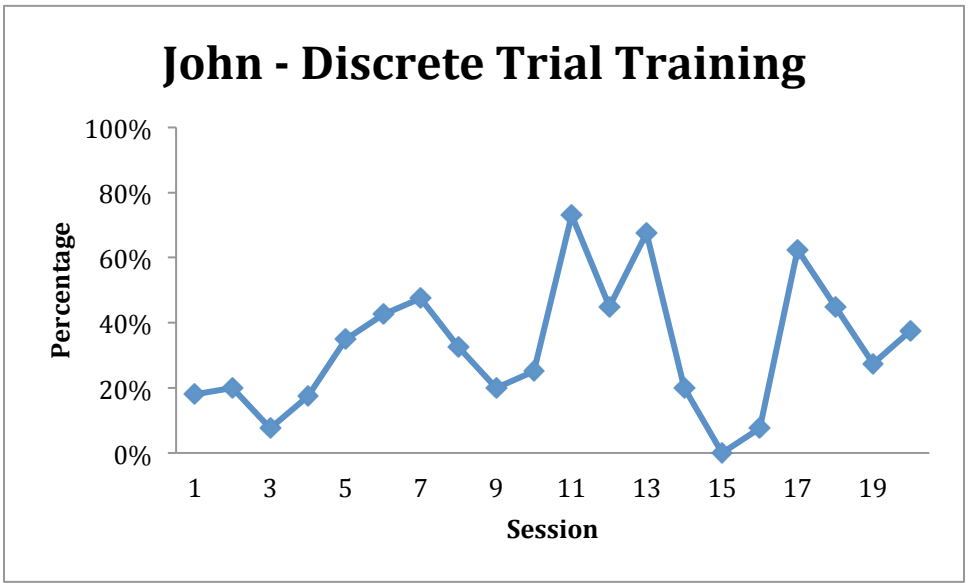

Figure 4. John: Discrete trial training in imitation

Hypothesis Two

The second hypothesis was that participants would show a greater increase in spontaneous imitation following a child-directed intervention compared to their spontaneous imitation following a discrete trial intervention in imitation. This hypothesis was examined by comparing individual performance on the spontaneous imitation assessment to both baseline performance and to performance in condition one. This data is depicted in Figure 1, with the x-axis representing the order of sessions and the y-axis representing the total number of spontaneous imitations performed during each child-directed session.

Between the baseline and second conditions, one participant demonstrated a change in spontaneous imitation while the other two participants evidenced either no change or skill maintenance. In particular, 70% of John's data points between baseline and condition two were nonoverlapping with evidence for a positive trend; between condition one and condition two, 45% of his data points were nonoverlapping, with a

similar positive trend between the two conditions. For Patrick, 75% of the data points between baseline and condition two were nonoverlapping, exhibiting a positive trend. However, comparing across conditions, it appeared as if the spontaneous imitation condition was helpful in maintaining his high level of performance in condition one, but did not improve upon it. That is, there was a stable level of performance between condition one and two with 0% of non-overlapping data points. 0% of Daisy's data points were nonoverlapping with no trend evident in the data; these findings were identical to her data between the first and second conditions.

Hypothesis Three

The final hypothesis stated that participants would demonstrate gains in expressive language skills over the course of the study. Expressive language skills were probed at the end of baseline, and the end of each intervention condition. Expressive language probes are depicted in Figure 1 and are single data points at the end of each condition.

Table 6 summarizes expressive language performance across baseline, teacher-directed imitation training, and child-directed imitation training.

Table 6.

Overall Expressive Language Results

Name	Baseline	Teacher-Directed	*Child-Directed*
Daisy	0	6	*12*
Patrick	13	14	*12*
John	0	1	*8*

Note. Scores represent number of words spoken.

Over the course of the study, two of the three participants demonstrated gains in expressive language, with one participant demonstrating increases after the teacher-directed intervention and two showing increases following the child-directed intervention. Specifically, Daisy demonstrated increases in expressive language following both types of intervention, going from zero words at baseline to six words following condition one,, to 12 words following condition two, child-directed imitation training.

John, who was just beginning to demonstrate verbal skills at the beginning of the study, spoke no words in response to the expressive language probe at baseline. When probed after completion of the first condition, John demonstrated a minor increase with a score of 1. However, following the second condition, John showed a relatively large increase on the expressive language probe, speaking a total of eight words.

In contrast, Patrick's level of expressive language remained virtually unchanged throughout the study. During the baseline expressive language probe, Patrick provided primarily one-word descriptors of each of the picture cards shown to him, speaking a total of 13 words. Following the first condition, teacher-directed imitation training, Patrick spoke a total of 14 words on the expressive language probe, and, on the probe following condition two, Patrick demonstrated a slight decrease, speaking 12 words.

CHAPTER V

DISCUSSION

Due to the crucial role of imitation in early development, especially in terms of language and social skill development, research examining interventions that have the potential to improve imitation skills in children with ASD are critical. The current study provides data on the effectiveness of two imitation interventions (teacher-directed and child-directed) on improving spontaneous imitation skills and expressive language skills in children with ASD. Four main findings can be gleaned from the data.

First, data indicate that teacher-directed imitation training in the form of discrete trial training is effective in improving spontaneous imitation for some children with ASD, but not all. Specifically, in this investigation, one participant demonstrated significant gains in spontaneous imitation during the teacher-directed imitation training condition. In contrast, the two other participants did not demonstrate significant change in performance during this condition. Similar conclusions can be drawn with regard to the effects child-directed imitation training on spontaneous imitation. That is, in this study one child demonstrated increases in spontaneous imitation following child-directed imitation training, but the other two children did not. Taken together, it is evident that no one intervention proved to be effective across the three participants in improving their spontaneous imitation skills. However, both interventions positively impacted expressive language development, as increases in expressive language skills were noted

after both the teacher-directed and the child-directed interventions in two out of three of the children.

Whereas other studies have shown effectiveness of both interventions, data from the current study do not consistently show benefits of either one. Previous studies examining the effectiveness of child-directed imitation training suggest that this method results in increases in spontaneous imitation in children with ASD (Ingersoll & Schreibman, 2010; Ingersoll, 2008). Differences in methodology between previous research and the current study may in part explain these different findings. First, one study which resulted in increases in spontaneous imitation for the participants after child-directed imitation training used familiar toys when engaging in imitation with participants (Ingersoll & Schreibman, 2010) whereas the current study used more standardized, unfamiliar toys. Had the participants in the current study been allowed to interact with objects that they found familiar or reinforcing, they have may demonstrated a higher amount of imitative behaviors. Another methodological difference was the amount and intensity of training participants received during the intervention. For example, children receiving intervention one hour per day, three days a week, for ten consecutive weeks demonstrated gains in spontaneous imitation (Ingersoll, 2010), whereas participants in this study received approximately 10-15 minutes per day, two to three days per week over the course of 16 weeks. Due to the fact that this study was conducted over the course of a typical preschool day, the timing of intervention implementation was sometimes dependent on factors outside of the research, such as school closings and illnesses. While with basic research it is possible to control the

majority such outside factors, applied research requires a higher degree of flexibility, as evidenced in the variability of the intervention.

Another possible explanation for the lack of consistent spontaneous imitation following either intervention may be related to the participants' levels of joint attention. Studies have suggested that attention, and more specifically joint attention, may serve as a precursor skill to imitation (Dawson, Toth, Abbott, Osterling, Munson, Estes, & Liaw, 2004). Joint attention has been linked to the general ability of social orienting, a relationship that is only evident in terms of the ability to attend to social stimuli, but not to nonsocial stimuli. This suggests that perhaps the joint attention deficit is especially evident when social cues are involved, therefore explaining why children do not attend to and then copy the social cues needed for imitation (Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998). As one of the primary needs in the social act of imitation is the recognition that one is being imitated, it may be that participants in the current study did not possess sufficient attention skills to recognize they were being imitated (Nadel, 2002). Further, while the experimenter prompted participants to attend to stimuli (i.e., the verbal prompt, "Look at me"), this may not have served as a strong enough manipulation in terms of increasing attention overall. Finally, at no point during the spontaneous imitation assessment were participants prompted to attend to the researcher.

Further support for the notion that joint attention may have mitigated the effects of the imitation interventions is found in the ADOS-2 data for the participants. There appears to be a clear relationship between the participants' scores on the ADOS-2 and their responses to the imitation interventions. The ADOS-2 provides specific scores for behaviors related to joint attention, including Response to Name, Spontaneous Initiation

of Joint Attention, and Response to Joint Attention. In the Response to Name subtest, the examiner calls the child's name up to six times to see if the child turns his or her head as a response. On the subtest Spontaneous Initiation of Joint Attention, the examiner rates the quantity and quality of the child's attempts to gain the examiner's attention. Finally, for Response to Joint Attention, the examiner attempts to gain the child's attention with a verbal prompt of "Look" followed by a point and then the activation of a noisy toy if the child does not respond initially (Lord, Rutter, Dilavore, Risi, Gotham, & Bishop, 2012).

Daisy, whose imitation data did not improve significantly during either intervention, had scores on all three of these tasks indicated a low level of social attention. Specifically, during the assessment, Daisy did not respond to the calling of her name after six presses by the examiner, did not engage in any type of initiation of joint attention, and did not follow the examiner's gaze or point toward an object in the room, indicating no response to joint attention. Similarly, John, who demonstrated more gains during the child-directed than the teacher-directed condition, did not respond to his name during the assessment, nor did he respond to a verbal prompt to call his attention to the examiner. He also did not engage in spontaneous initiation of joint attention and did not follow the examiner's gaze toward an object, but he did look toward the object when the examiner pointed at it, suggesting somewhat better joint attention skills. In contrast to both Daisy and Patrick, John, who made the largest gains in spontaneous imitation in the teacher-directed condition and maintained those gains in the child-directed condition, demonstrated stronger attention skills on the assessment. While he did not spontaneously attempt to engage the examiner in joint attention, he responded immediately to his name when the examiner said it and followed the examiner's gaze toward an object in the room

on his first try. Due to evidence provided by previous research on the importance of recognizing that one is being imitated, participants' differing levels of attention (Nadel & Fontaine, 1989) – and more specifically, joint attention – may have contributed to their varying levels of performance on the spontaneous imitation assessment.

Additional evidence for differences in participants' joint attention skills prior to the start of the current study can be found in behavioral observations made from the video recorded sessions. Observed social behaviors – including joint attention, eye contact, and shared affect – were more frequent with concurrent increases in spontaneous imitation. Behavioral observations of both intervention and assessment show Patrick's high level of attention to the examiner during the teacher-directed imitation condition, through eye contact and orientation to the examiner in general, which may have explained the subsequent gains in spontaneous imitation. In fact, during the child-directed condition of the study, video recordings show Patrick verbally requesting the experimenter to do what he was doing (e.g., "You swing boa!") during the assessment portion of the section condition. He also frequently told the experimenter that they were "doing same thing!" before the experimenter provided him with any feedback on his actions; additionally, this comment by Patrick was often offered with positive tone, suggesting shared enjoyment in the imitation activity. This awareness of being imitated likely impacted his performance on spontaneous imitation, and possibly also his enjoyment, therefore further implying the importance of joint attention in the context of imitation. In other words, due to Patrick's increase attention to the adult in the room, he may have been more likely to imitate that adult's actions.

Behavioral observations of John during the child-directed imitation condition indicate similar demonstrable changes in engagement, attention, and verbal behavior during the child-directed imitation training condition. During the five minutes of being imitated by the experimenter, John often watched the experimenter, giggled at her behaviors, and specifically, tried to remove his bowl of popcorn from the vicinity of the experimenter, as to imitate him, she was often eating it. This attempt to hide his snack from the experimenter evidences his attention and awareness of the experimenter's actions. During spontaneous imitation assessments, John was observed to make more eye contact with the experimenter, stay focused on the task at hand (i.e., remaining close to the experimenter during the tasks rather than running around the room), and repeat more of the experimenter's descriptions of her actions.

In contrast to behavioral observations of Patrick during both conditions and John during the child-directed condition, Daisy was observed to rarely look in the direction of the experimenter and would move back and forth across the room frequently without attention to the examiner's actions. Additionally, she often became fixated on activities such as spinning in circles and looking out the window. Due to this lack of attention, it is likely that Daisy was unaware of the experimenter's actions and therefore did not imitate them. Taken together, behavioral as well as quantitative assessment data indicated that there may have been pre-experimental differences in joint attention skills across the participants, which may have had implications in their spontaneous imitation performances during both teacher-directed and child-directed conditions.

A second possible explanation for individual differences observed in responses to the intervention is related to the severity of autism characteristics displayed by the

participants. Data from the ADOS-2 which measures the severity of various symptomatology associated with autism (Lord, Rutter, Dilavore, Risi, Gotham, & Bishop, 2012, indicated differences in levels of ASD severity among the three participants. Patrick, who demonstrated more gains in spontaneous imitation as well as maintenance of those gains in comparison to Daisy and John, also exhibited fewer autism characteristics. Specifically, Patrick's score was 10 reflecting a diagnosis of being on the autism spectrum, while both Daisy's and John's scores of 20 and 19, respectively, indicated diagnoses of autism, suggesting that the latter two participants' symptomology was more severe. It is possible that Patrick's stronger performance was somewhat related to his generally higher functioning (Eikeseth, Smith, Jahr,,& Eldevik, 2002). Previous research has demonstrated the relationship between severity of autism symptoms and responsiveness to early intervention treatment. Specifically, research examining the effects of early and intensive behavioral interventions for young children with ASD has demonstrated that children demonstrating higher intellectual functioning as well as fewer deficits in social behaviors tend to demonstrate larger gains in areas such as receptive and expressive language as well as play skills (Ben-Itzchak & Zachor, 2007).

Overall, the finding that neither intervention seemed to be effective for all participants suggests that the aforementioned individual differences in joint attention and ASD symptom severity my have served as significant contributors to participants' changes, or lack thereof, in spontaneous imitation skills. It has been well-established that ASD is not a homogeneous disorder but rather an extremely heterogeneous one, as reflected in the newly-established diagnostic criteria for the disorder, with functioning levels now being included in the overall diagnosis (APA, 2014). The results of the

current study indicate that future research in imitation in children with ASD take into consideration how these individual differences may play a part in response to interventions.

Despite the lack of impact of the interventions on children's spontaneous imitation skills, results did indicate increases in expressive language skills for two out of three of the participants following both interventions with the largest increases occurring after implementation of child-directed imitation training. While previous research has found that children with stronger skills in imitation are more likely to have better expressive language skills (e.g., Freitag, Kleser, & von Gontardf, 2005; Stone & Yoder, 2001), the participant who made the most gains in imitation – Patrick – demonstrated the least gains in expressive language. One explanation for this finding may be the fact that Patrick began the study with a relatively high level of language in comparison to Daisy and John. Both Daisy and John spoke no words in on the baseline probe for expressive language, while Patrick spoke a total of thirteen words.

It is important to note that previous studies examining expressive language development in children with ASD as well as how those skills related to their imitation skills used more extensive measures than the one used in the current study. For example, one study examined both parental report and direct observation through three different standardized measures in order to assess children's expressive language skills (Stone & Yoder, 2001). These more extensive instruments likely provided more complex information than this study's picture card method; had the same measures been employed in this study, these more sensitive measures may have found more similar results to

previous research. This difference in methodologies may explain the discrepancy between the current study's findings in expressive language and previous literature.

In addition to pre-treatment individual differences, there may be other variables at play in expressive language development. One such hypothesis is the increase in the amount of verbal language the children were exposed to by this point in the study. The participants had heard many phrases repeated over the course of numerous months (e.g., "We're doing the same thing!", "I'm rolling the ball!"). Due to children with ASD's preference of routine, this predictable language exposure may have made them more likely to pick up on what was being said (APA, 2014).

However, it is important to acknowledge the fact that the expressive language assessment that was administered to the participants did not require them to use language they had heard the experimenters speak but rather identify unrelated objects (i.e., dog, cat, shoes). Therefore, experimenters were not teaching participants vocabulary such as "dog", "cat", or "shoes", which would have assisted them in completing the expressive language assessment. Rather, experimenters were describing actions both that they were doing as well as that the participants were doing. Had participants been required to identify objects used during the imitation training trials, they may have demonstrated an even larger increase in expressive language due to more familiarity with that specific language. It is also likely that the interventions the participants were receiving concurrently through the early intervention program played a part in the participants' expressive language skill development.

Limitations and Future Research

While the current study offers new information on imitation skill development in children with ASD indicating that children have individual differences in their response to different imitation interventions, the data collected do not allow us to make conclusions about which children would benefit from teacher-directed versus child-directed interventions. Future research should examine the effects of attention and, more specifically, joint attention on imitation. It has been well established that children with ASD often display deficits in joint attention (Osterling & Dawson, 1994; Osterling, Dawson, & Munson, 2002). Research has also examined the developmental trajectories of social skill development in children with ASD, results of which have suggested that joint attention may not only be related to imitation but may in fact serve as a precursor skill (Carpenter, Pennington, & Rogers, 2002; Dawson, Meltzoff, Osterling, Rinaldi, & Brown, 1998; Dawson et al., 2004). Due to not only the broad impairment in joint attention, but also to studies that have shown children with ASD's lower levels of attention to social stimuli in particular, a hypothesis that children with more intact joint attention skills would perform better on spontaneous imitation tasks is one worth investigating (Dawson et al., 2004). Additionally, research should examine the role that functioning level plays in the effectiveness of imitation interventions. Future research should aim to investigate the effects of these two interventions on a larger scale.

Another limitation of the study was related to the applied nature of the intervention, which resulted in children's participation to vary in terms of intensity. That is, the interventions were conducted during the participants' regular early intervention program, and thus, their participation in sessions on any given day was dependent on

their attendance in the program. Due to participant illnesses along with weather-related closings and scheduled closings due to seasonal holidays, the intervention implementation was less consistent than may be ideal. As research in early intervention for children with ASD has suggested better outcomes when more intensive services are provided, more positive results may have been evidenced if the intervention would have been provided on a more structured, regular schedule (Eikeseth, Smith, Jahr, & Eldevik, 2007). Future research in this area should investigate ways to implement the interventions in a more structured, consistent manner, such as conducting interventions separately from other treatment schedules as well as increasing the frequency of intervention delivery during the week to complete it in a shorter period of time, thereby possibly avoiding holidays and other availability concerns. Additionally, future research should compare different levels of intensity of intervention in order to identify what is necessary and sufficient to make gains.

Because the interventions were given to all participants in the same order, rather than being counter-balanced, the potential benefits of the spontaneous imitation intervention may have been compromised. Due to the fact that discrete trial training is, by nature, a structured, routine intervention, it is possible that the participants became accustomed to imitating the experimenter only when prompted to do so. Especially for the two participants who received the teacher-directed imitation training for a total of twenty trials, it may be that these participants had difficulty transitioning between the teacher-directed and child-directed imitation training conditions and therefore have struggled to understand what was expected of them. For example, due to the fact that children with ASD typically demonstrate rigid adherence to routines and struggle with

flexibility, participants who received twenty sessions of teacher-directed imitation training may have become accustomed to the structure of these sessions and had more difficulty performing in a very different routine (Ingersoll, 2008). Further research examining whether alternative research designs, such as an ABAB pattern alternating between teacher-directed and child-directed imitation training, may provide answers to this question.

Finally, it should be noted that John and Daisy failed to consistently demonstrate mastery of discrete trial training imitation, therefore limiting the conclusions that can be drawn about teacher-directed imitation training's effects on spontaneous imitation development. It is possible that these participants may have demonstrated different performances on the spontaneous imitation assessment had their imitation skills in discrete trial training been stronger. Future research should consider the differential length and intensity of interventions needed to be sufficient to not only build corollary spontaneous imitation skills but also to strengthen those skills (i.e., elicited imitation) directly targeted by the intervention.

Conclusions

One of the strengths of the current study is that due to its single subject, multiple baseline design, generalizations can be drawn because the design allows for the demonstration of cause and effect relationships rather than solely correlations. While the data does not supply strong evidence for the differential effectiveness of either teacher-directed or child-directed imitation interventions in terms of spontaneous imitation gains, the differences in performance observed between participants with higher levels of joint attention and lower levels of autism symptoms compared to participants with less

developed joint attention skills and higher levels of autism symptoms suggests implications for imitation interventions as a whole.

First, the differences in severity of autism characteristics among participants as determined by the ADOS-2 suggests that perhaps children with less severe characteristics may more highly benefit from child-directed imitation interventions in comparison to children who are more impacted by autism symptomatology. Additionally, as Daisy and John did not evidence an absence of gains entirely, it may be that imitation interventions more suited for their level of skill at the time of implementation may prove more effective. In other words, imitation interventions that incorporate additional social behavioral aspects, such as joint attention, may serve to supplement the imitation component; for example, if an intervention aimed to increase children's attention to the researcher, greater increases in spontaneous imitation may also be achieved.

Behavioral observations taken from recorded intervention and assessment sessions show that Patrick, who showed the strongest gains in spontaneous imitation skills over the course of the study, demonstrated evidence of attention to the experimenter in contrast with the relatively low levels of this behavior shown in the other two participants. This may suggest the need for clinicians and researchers to assess a child's level of joint attention as well as overall attention to social stimuli (i.e., other individuals) prior to the implementation of imitation interventions in order to determine whether a child would benefit. Additionally, if it is determined that a child has relatively low levels of attention, it may be helpful to conduct interventions to improve joint attention skills as a precursor program for later imitation interventions.

Results from the current study also support previous findings that show a link between imitation and expressive language skills (e.g., Stone & Yoder, 2001). Therefore, this suggests that imitation interventions may be effective not only for their intended purpose but also for increasing expressive language development, even in children who are primarily nonverbal. This finding may be especially useful for short-term treatment facilities or treatment providers that are limited on time and resources; by targeting one skill, the child may develop further in a collateral skill as well, thereby saving clinician resources and serving as an efficient treatment.

Finally, this study contributes to the larger body of research on the effectiveness of interventions that target essential skills that are often impaired in children with ASD. As the prevalence of ASD has been shown to be on the rise, with 1 in 150 diagnosed in 2000 and now 1 in 68 diagnosed in the latest research, it is imperative for researchers to continue to study intervention effectiveness for this population (CDC, 2014). While further research is needed to examine how various factors may contribute to imitation intervention effectiveness, this study provides the first known data on the differential effectiveness of teacher-directed imitation training in the form of discrete trial training versus child-directed imitation training on spontaneous imitation and expressive language skills.

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APPENDIX A

CODING SHEETS

PARTICIPANT ID		**EXPERIMENTER**		**CODER**	
DATE OF SESSION		**DATE OF CODING**		**DOUBLE CODED?**	

SPONTANEOUS IMITATION ASSESSMENT – *BASELINE/CONDITION 1/CONDITION 2*

TASK	TRIAL 1 (1ST VERBAL PROMPT)	TRIAL 2 (2ND VERBAL PROMPT)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

PARTICIPANT ID		**EXPERIMENTER**		**CODER**	
DATE OF SESSION		**DATE OF CODING**		**DOUBLE CODED?**	

TEACHER DIRECTED IMITATION TRAINING (CONDITION 1)

TASK	PROMPT REQUIRED (+ = no prompts/independent, V = repeated verbal, - = full physical
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

PARTICIPANT CODE:	CONDITION:
EXPERIMENTER:	

EXPRESSIVE LANGUAGE ASSESSMENT

Flower

Shoes

Door

House

Car

Bed

Tree

Cup

Dog

Cat

APPENDIX B

IMITATION TASKS

IMITATION TASKS
OBJECT

TASK: Clap spoons
DTT Administration: Say "Do this!" and then clap two spoons together. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am clapping the spoons!" and then clap two spoons together. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): clap spoons

If full imitation: "Good doing this!" (DTT)/ "We're doing the same thing!" (Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Roll car
DTT Administration: Say "Do this!" and then roll the car across the table. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am rolling the car!" and then roll the car across the table. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): roll car
Feedback:

If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

If partial/incorrect/no imitation: "Good sitting!"/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Place umbrella over head
DTT Administration: Say "Do this!" and then put the umbrella over your head. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting the umbrella over my head!" and then put the umbrella over your head. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put umbrella over head
Feedback:

If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)! (Spontaneous)

TASK: Bounce ball

DTT Administration: Say "Do this!" and then bounce the ball once. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am bouncing the ball!" and then bounce the ball once. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): bounce ball
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put pacifier in doll's mouth
DTT Administration: Say "Do this!" and then place the pacifier in the doll's mouth (**make sure the pacifier is already removed from the doll's mouth)**. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am giving baby pacifier!" and then place the pacifier in the doll's mouth. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): place pacifier in doll's mouth
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Clap kaleidoscopes
DTT Administration: Say "Do this!" and then clap kaleidoscopes once. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am clapping kaleidoscopes!" and then clap cups once. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): clap kaleidoscopes together
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Swing boa

DTT Administration: Say "Do this!" and then swing the boa over your head once. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am swinging the boa!" and then swing the boa you're your head once. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): swing boa over head once (if the child swings the boa over his/her head more than once, still considered a full imitation)
Feedback:

If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Hold cup to doll's mouth
DTT Administration: Say "Do this!" and then hold the cup to the doll's mouth. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child. Retrieve the ball each time.
Spontaneous Administration: Say "I am giving the cup to the doll!" and then hold the cup to the doll's mouth. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): hold cup to dolls' mouth
Feedback:

If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

If partial/incorrect/no imitation: "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put spoon in box
DTT Administration: Say "Do this!" and then put the spoon in the box. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting the spoon in the box!" and then hold the umbrella over your head. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put spoon in box
Feedback:

If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put blanket on doll
DTT Administration: Say "Do this!" and then lay the blanket on top of the baby doll. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am covering the baby!" and then lay the blanket on top of the baby doll. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): lay blanket on top of baby doll
Feedback:
If full imitation: "Good doing this!"(DTT)/ "We're doing the same thing!" (Spontaneous)
If partial/incorrect/no imitation: "Good sitting!"(DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Hold kaleidoscope to eye
DTT Administration: Say "Do this!" and then hold the kaleidoscope to your eye. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am looking through the tube!" and then hold kaleidoscope to eye. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): hold kaleidoscope to eye
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Rock baby doll
DTT Administration: Say "Do this!" and then rock the baby doll in your arms. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am rocking the baby!" and rock the baby doll in your arms. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): rock baby doll in arms
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Roll ball

DTT Administration: Say "Do this!" and then roll the ball. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am rolling the ball!" and then roll the ball. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): roll ball
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put ball in box
DTT Administration: Say "Do this!" and then put the ball in the box. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting the ball in the box!" and then put the ball in the bucket. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put ball in box
Feedback:

If full imitation: "Good putting ball in bucket!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Shake kaleidoscope
DTT Administration: Say "Do this!" and then shake the kaleidoscope. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am shaking the kaleidoscope!" and then shake the kaleidoscope. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): shake kaleidoscope
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Stack bowls
DTT Administration: Say "Do this!" and then put one bowls on top of the other. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am stacking bowls!" and then put one bowl on top of the other. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): putting one bowl on top of the other
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Pretend to eat out of bowl with spoon
DTT Administration: Say "Do this!" and then pretend to eat out of the bowl with the spoon. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am eating out of the bowl with the spoon!" and then pretend to eat out of the bowl with the spoon. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): pretend to eat out of bowl with spoon (raise spoon to lips)
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Stack plates
DTT Administration: Say "Do this!" and then put one plate on top of the other. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am stacking plates!" and then put one plate on top of the other. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put one plate on top of the other
Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Pretend to drink out of cup

DTT Administration: Say "Do this!" and then pretend to drink out of the cup. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am drinking!" and then pretend to drink out of the cup. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): hold kaleidoscope to eye
Feedback:

If full imitation: "Good drinking!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Stack boxes
DTT Administration: Say "Do this!" and then put one box on top of the other. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am stacking boxes!" and then put the hat on the doll's head. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put one box on top of the other
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

MOTOR

TASK: Raise hand
DTT Administration: Say "Do this!" and then raise your hand. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am raising my hand!" and then raise your hand Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): raise hand
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Clap hands

DTT Administration: Say "Do this!" and then clap your hands once. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am clapping my hands!" and then clap your hands once. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): clap hands (at least once)
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Thumbs up
DTT Administration: Say "Do this!" and then make a thumbs up gesture. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am giving a thumbs up!" and then make a thumbs up gesture. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): make thumbs up gesture
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Wave hand
DTT Administration: Say "Do this!" and then wave your hand. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am waving my hand!" and then wave your hand. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): wave hand (at least once)
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on wall
DTT Administration: Say "Do this!" and then put your hand on the wall. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on the wall!" and then put your hand on the wall. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on wall
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Nod head
DTT Administration: Say "Do this!" and then nod your head once. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am nodding my head!" and then nod your head once. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): nod head (at least once)
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Shake head
DTT Administration: Say "Do this!" and then shake your head side to side. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am shaking my head!" and then shake your head side to side. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): shake head side to side
Feedback:

If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Point at window
DTT Administration: Say "Do this!" and then point at the window. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I pointing at the window!" and then point at the window. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): point at window

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on cheek

DTT Administration: Say "Do this!" and then put your hand on your cheek. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on my cheek!" and then put your hand on your cheek. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): put hand on cheek

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on nose

DTT Administration: Say "Do this!" and then put your hand on your nose. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on my nose!" and then put your hand on your nose. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): put hand on nose

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on head

DTT Administration: Say "Do this!" and then put your hand on your head. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on my head!" and then put your hand on your head. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): put hand on head

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Make fist

DTT Administration: Say "Do this!" and then make a fist. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am making a fist!" and then mak a fist. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): make a fist

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on shoulder

DTT Administration: Say "Do this!" and then put your hand on your shoulder. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on my shoulder!" an then put your hand on your shoulder. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): put hand on shoulder

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

<u>If partial/incorrect/no imitation:</u> "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on elbow

DTT Administration: Say "Do this!" and then put your hand on your elbow. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.

Spontaneous Administration: Say "I am putting my hand on my elbow!" and then put your hand on your elbow. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.

Operational Definition (both for researcher + participant): put hand on elbow

Feedback:

<u>If full imitation:</u> "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on table
DTT Administration: Say "Do this!" and then put your hand on the table. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting my hand on the table!" and then put your hand on your elbow. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on table
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Tap table
DTT Administration: Say "Do this!" and then tap the table with your hand. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am tapping the table!" and then tap the table with your hand. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): tap table with hand
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on neck
DTT Administration: Say "Do this!" and then put your hand on your neck. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting my hand on my neck!" and then put your hand on your neck. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on neck
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)

If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on mouth
DTT Administration: Say "Do this!" and then put your hand on your mouth. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting my hand on my mouth!" and then put your hand on your neck. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on mouth
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on eye
DTT Administration: Say "Do this!" and then put your hand on your eye. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting my hand on my eye!" and then put your hand on your eye. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on eye
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

TASK: Put hand on ear
DTT Administration: Say "Do this!" and then put your hand on your ear. Follow-up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, physically prompt the child.
Spontaneous Administration: Say "I am putting my hand on my ear!" and then put your hand on your ear. Follow up with a second identical prompt if the child does not respond. If the child does not respond after two prompts, **do not** physically prompt the child.
Operational Definition (both for researcher + participant): put hand on ear
Feedback:
If full imitation: "Good doing this!"(DTT)/"We're doing the same thing!"(Spontaneous)
If partial/incorrect/no imitation: "Good sitting!" (DTT)/ "You're (something the child is doing at that moment)!" (Spontaneous)

APPENDIX C

PICTURE CARDS

Card 1: Dog

Card 2: Flower

Card 3: House

Card 4: Chair

Card 5: Cat

Card 6: Car

Card 7: Soccer ball

Card 8: Bed

Card 9: Bird

Card 10: Bicycle

APPENDIX D

TREATMENT INTEGRITY CHECKLIST

CODE	DATE	EXPERIMENTER	TASK	YES, NO, N/A	TI COMPLETED BY:	DATE COMPLETED:
			1. Researcher conducts 10 spontaneous imitation assessment trials (5 object, 5 motor)			
			2. **C1** only: Researcher conducts 10 imitation training trials (5 object, 5 motor)			
			8. **C1 only**: Researcher uses cue "Look at me" to get participant's attention			
			9. **C1 only**: Researcher says "Do this" and models action			
			10. **C1 only**: Researcher uses verbal/physical prompts when appropriate to provide feedback on imitation performance			
			11. **C2 only**: Researcher imitates child's behavior for five minutes			